RAINWATER HARVESTING SYSTEM DESIGN GUIDE

COMPLETE GUIDE TO RAINWATER HARVESTING SYSTEMS

RMS

RAINWATER MANAGEMENT SOLUTIONS™

about us

Rainwater Management Solutions is an industry-leading professional services firm, specializing in turn-key solutions for rainwater and stormwater management.

60+ YEARS

RMS has more than 60 years of combined experience in the rainwater & stormwater reuse industry

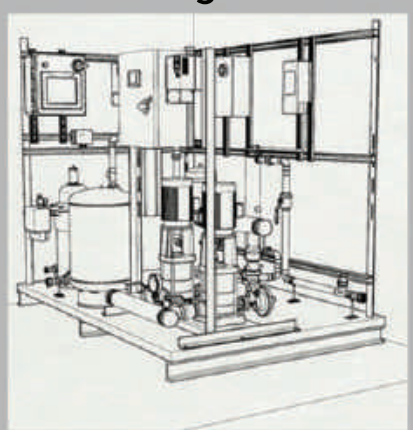
RMS provides complete rainwater harvesting systems and solutions for residential, commercial, industrial, and agricultural projects. The firm provides professional design and consulting services to its clients, which include development, engineering, and architectural firms seeking specialized rainwater and stormwater management system design capabilities.

Complete design support through the following:

- Sizing the tank, filtration equipment, pumps and other integral components
- Ensuring system integration and component compatibility
- 2D and 3D AutoCAD drawings available
- Feasibility Studies
- Specifications for your specific system or easily adaptable specifications allowing you to finalize your own design
- Retrofits to create functioning, efficient rainwater harvesting systems

RMS also offers complete **Start-up** and **Training Support** for its rainwater harvesting systems

RMS designs and builds custom purification skids, pump skids, and controls



from inception...

to design...

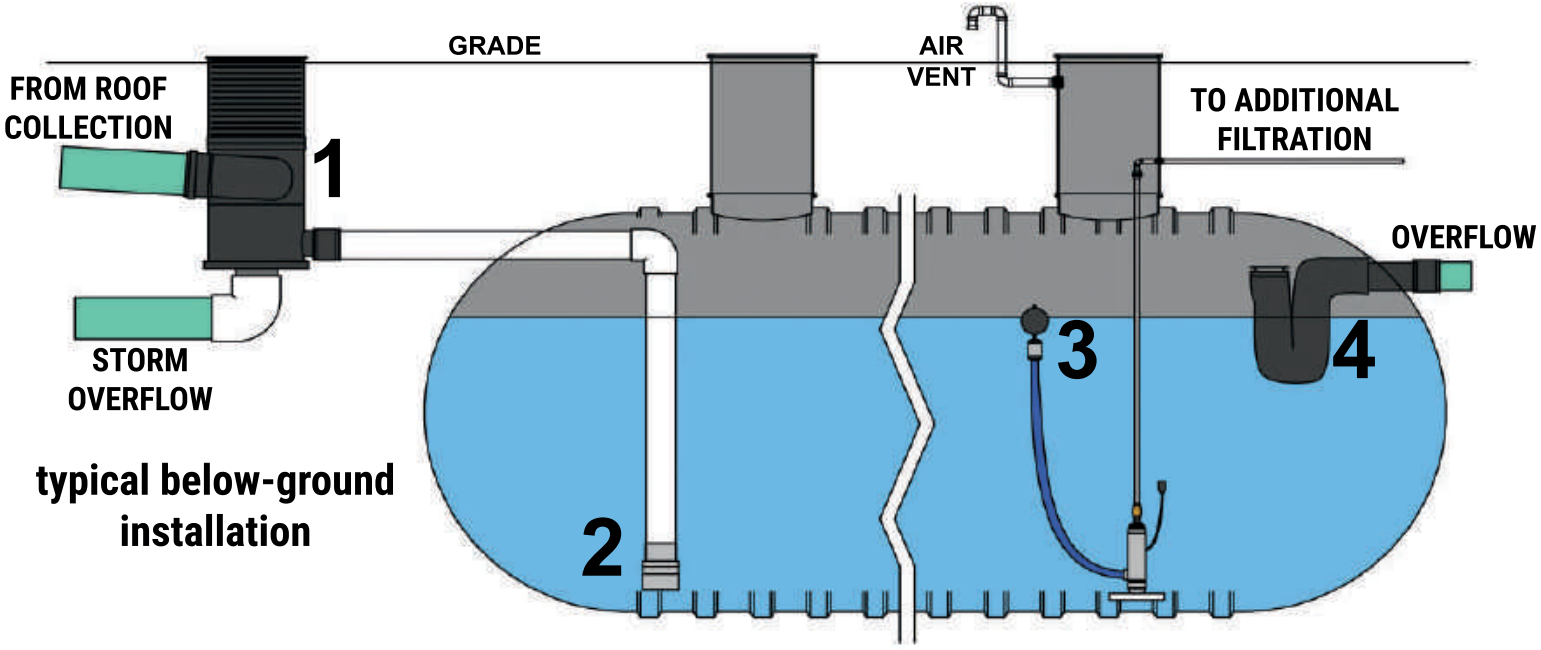
to production

CONTACT US:
TOLL-FREE: 1-866-653-8337
www.rainwatermanagement.com

wisy 4-step system

After more than 20 years in the rainwater industry, Rainwater Management Solutions has identified the **WISY 4-Step System** as the ideal method for rainwater harvesting. This method provides the best pre-tank filtration by way of the WISY Vortex Filter, which is regarded internationally as the best pre-filtration method. Pre-filtration reduces the amount of debris in the tank, promotes a healthy tank environment, and reduces system maintenance. RMS is the exclusive North American distributor of the WISY product line.

The schematic below is a typical below-ground installation using the WISY 4-Step System for rainwater harvesting.



typical below-ground installation

1. PRE-TANK FILTRATION

- low maintenance filter
- removes rooftop debris
- protects tank water quality
- install above or below ground
- filter capacity up to 33,000 ft²

2. SMOOTHING INLET

- prevents tank stirring
- oxygenates the water
- protects tank water quality

3. FLOATING FILTER

- sits below water surface
- takes in the cleanest water

4. OVERFLOW DEVICE

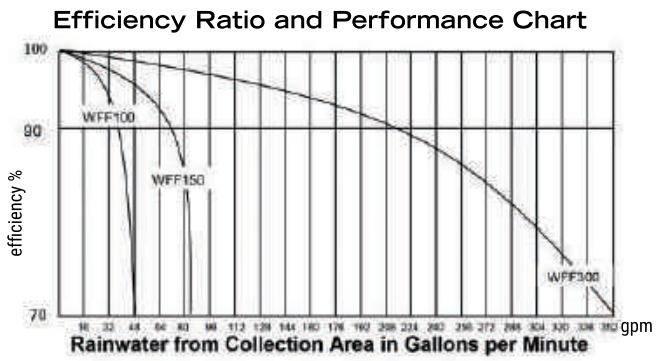
- skims floating particles
- protects tank water quality

Following these easy four steps ensures minimal particulate in the water, which makes down-stream filtration methods more effective and minimizes frequency of maintenance

pre-tank filtration

We firmly believe that proper pre-tank filtration is necessary in order to have the highest quality water for your rainwater harvesting application. Reducing the amount of debris that enters the tank creates the healthiest water conditions in the tank, reduces the amount of harmful pathogens as well as water discoloration, prolongs the life of equipment, and reduces the amount of maintenance that needs to be done post-tank.

WISY filters drastically reduce the amount of sediment that enters the tank by drawing water through a fine stainless-steel mesh into a separate chamber after first flush has been achieved. Debris will remain on the other side of the mesh, washing away to storm drain.



WISY filters are highly efficient when sized correctly, with the filter sending 95% of the water to the storage tank in most applications. Filters should be sized based on roof area to maximize efficiency by using the chart below. When roof area exceeds that of a WISY filter, more filters can be added. Most filters can be installed both above or below ground.

PRE-TANK FILTER	MAX ROOF AREA	MESH SIZE	DIMENSIONS		PIPE SIZE	
 DOWNSPOUT FILTER	1,600 FT²	280 microns (0.011")	4¾"	LENGTH	4"	INLET TO FILTER
			4¾"	WIDTH	2"	CLEAN OUTLET
			13⅞"	HEIGHT	4"	STORM OUTLET
 LineAr 100	2,100 FT²	280 microns (0.011")	18¾"	LENGTH	4"	INLET TO FILTER
			6"	WIDTH	4"	CLEAN OUTLET
			12½"	HEIGHT	4"	STORM OUTLET
 WFF100 VORTEX FILTER	2,100 FT²	280 microns (0.011")	12⅜"	LENGTH	4"	INLET TO FILTER
			12⅜"	WIDTH	4"	CLEAN OUTLET
			19"	HEIGHT	4"	STORM OUTLET
 WFF150 VORTEX FILTER	5,500 FT²	280 microns (0.011")	12⅜"	LENGTH	6"	INLET TO FILTER
			12⅜"	WIDTH	4"	CLEAN OUTLET
			28⅜"	HEIGHT	6"	STORM OUTLET
 WFF300 VORTEX FILTER	33,000 FT²	380 microns (0.015")	28"	LENGTH	12"	INLET TO FILTER
			28"	WIDTH	8"	CLEAN OUTLET
			40"	HEIGHT	12"	STORM OUTLET

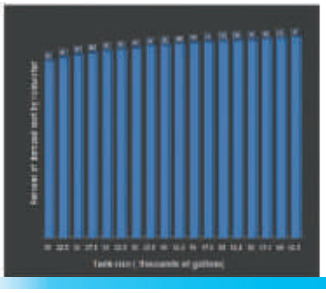
EXTENSION TUBE(S) CAN BE ADDED TO WFF100, WFF150, WFF300 TO BRING FILTER TO GRADE

storage options

RMS works with leading tank providers across the country to ensure that the tank will meet the project's requirements. A variety of storage tanks are available in above and below-ground applications with materials of construction including:

- Metal (corrugated and smooth wall)
- Fiberglass
- Polyethylene
- HDPE Pipe
- Modular tanks

In addition, RMS can manufacture tanks for custom applications where dimensions and atypical fittings may be a factor.



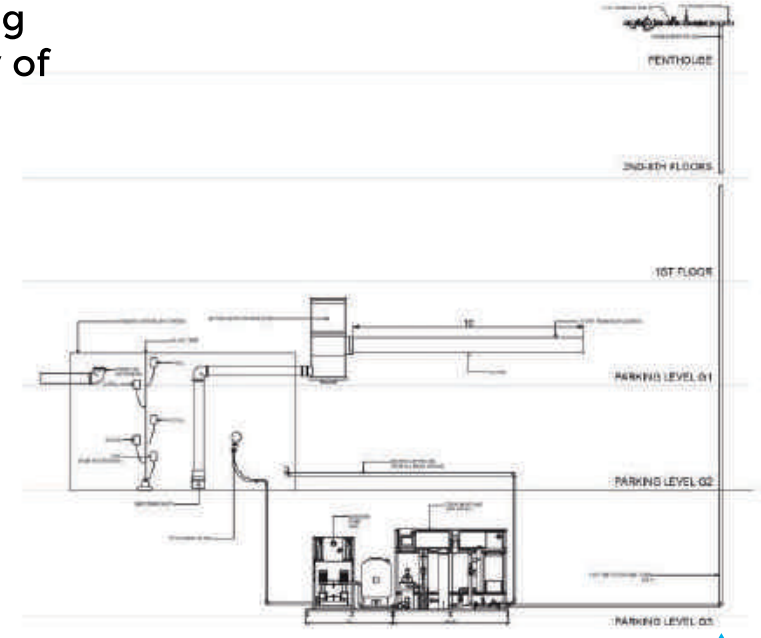
tank sizing

We utilize tank sizing software to identify the appropriately sized tank to ensure the proper amount of storage, allow for system overflow to promote water quality, and reduce costs when possible.

application design

We have extensive experience in designing rainwater harvesting systems for a variety of water re-use applications such as:

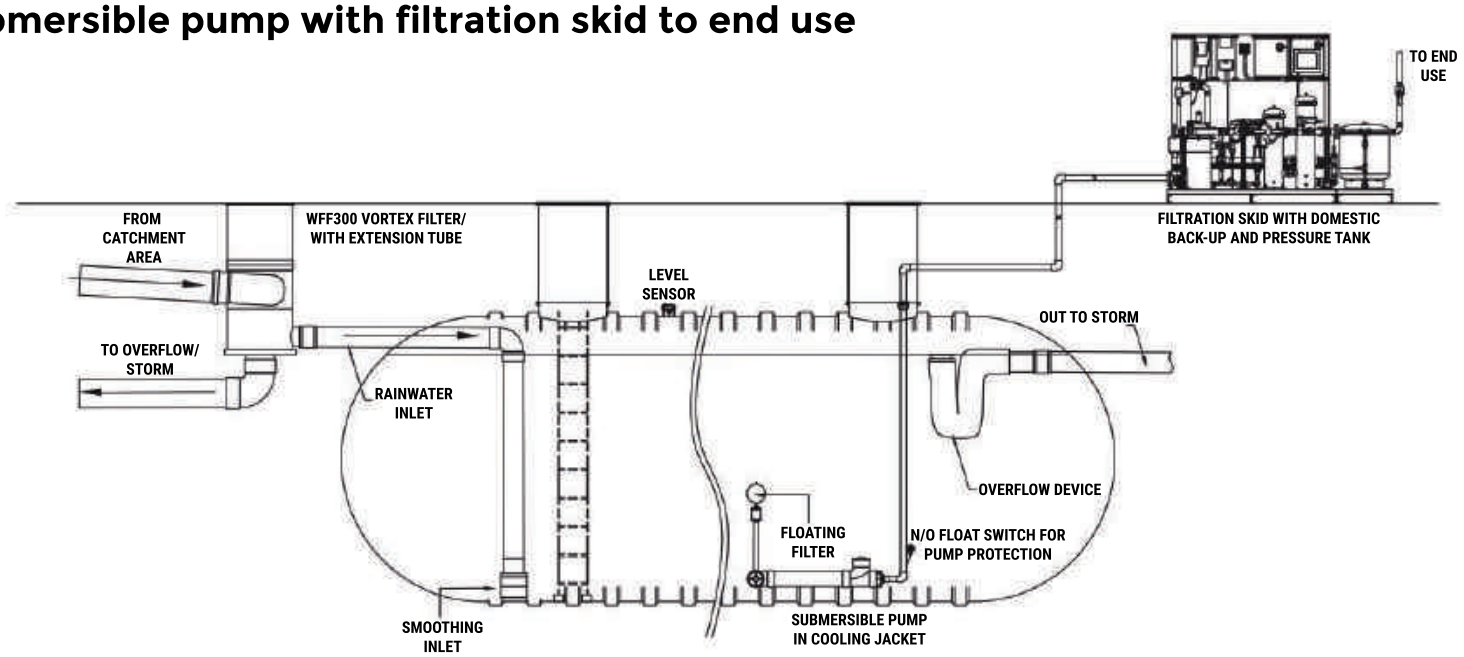
- toilet flushing
- cooling tower make-up
- vehicle washing
- irrigation
- fire suppression
- laundry
- process water
- pool/pond filling



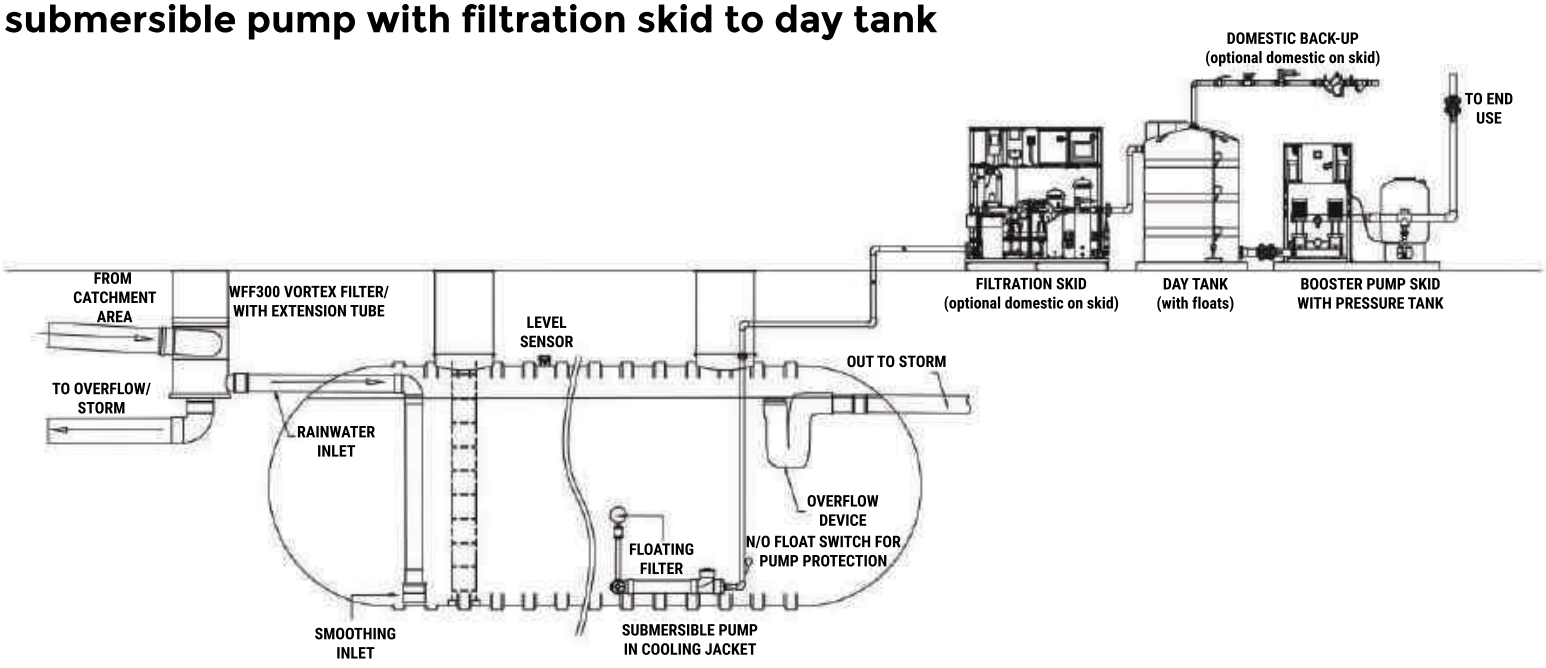
system designs

All system designs shown can be used in above and below ground applications. Schematics below are adaptable/customizable to meet project needs and specifications.

submersible pump with filtration skid to end use

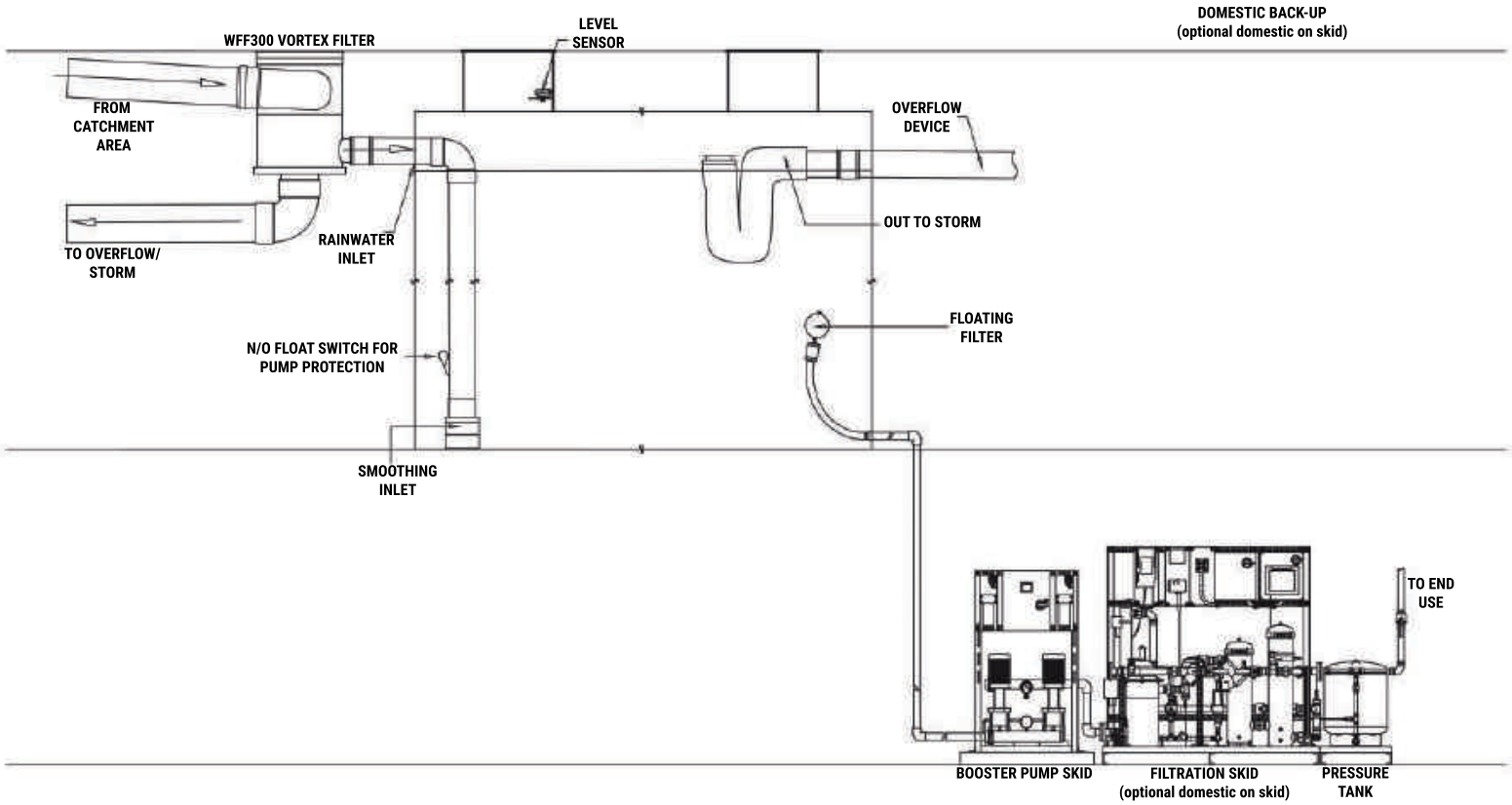


submersible pump with filtration skid to day tank

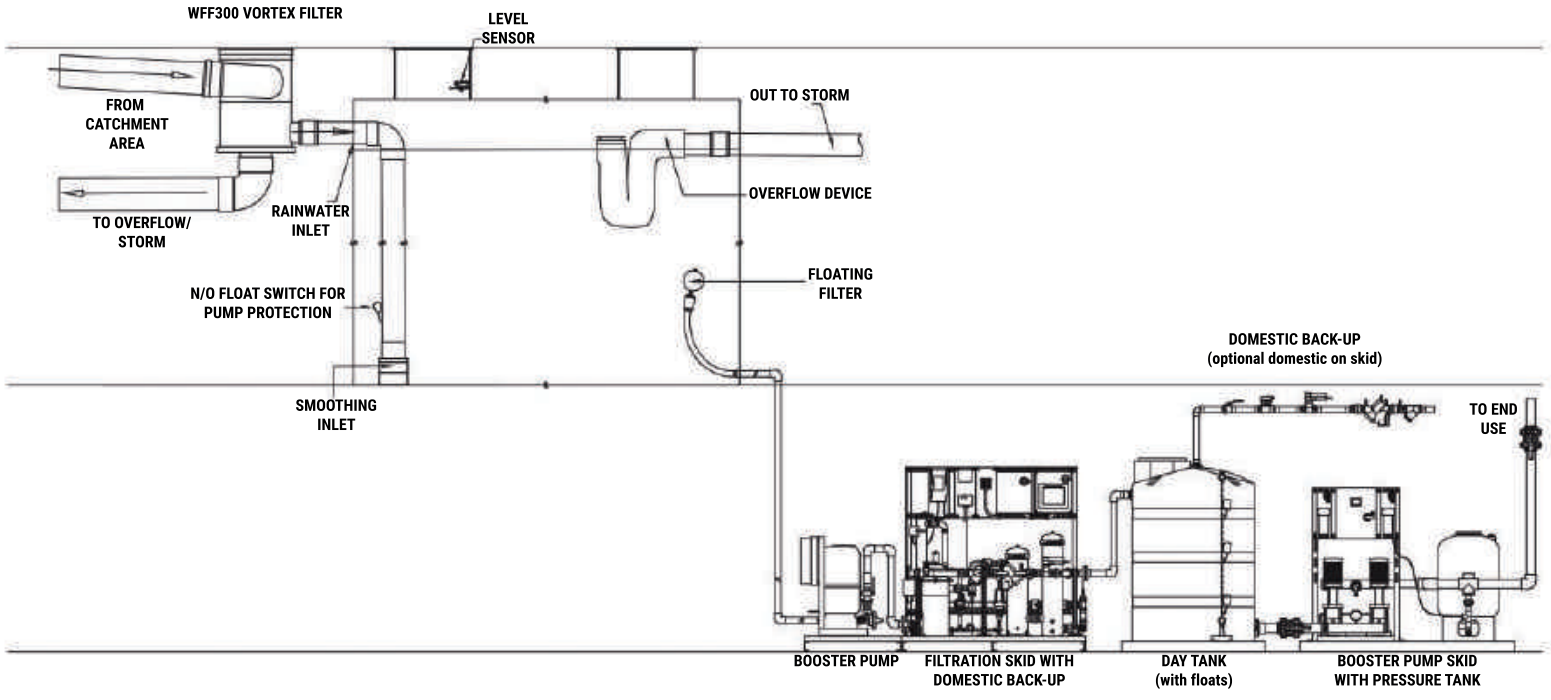


All system designs shown can be used in above and below ground applications. Schematics below are adaptable/customizable to meet project needs and specifications.

booster pump with filtration skid to end use



booster pump with filtration to day tank



pumping systems

While project applications and requirements can vary, we have a solution for your pumping needs:

- booster/jet
- submersible
- recirculation
- centrifugal

We have pumps to meet a wide variety of horsepower, flow, pressure/TDH, and voltage demands for your project requirements. RMS also builds custom, manufacturer- approved cooling jackets to house large pumps and motors.

VFD

We have partnered with an industry-leader to develop a variable frequency drive specifically for rainwater harvesting applications. A custom macro in the VFD reduces on-site start-up to merely setting the desired pressure.

booster pump skids

In addition to standard transfer pumps that provide water to a day tank or to end use, RMS can provide booster pump skids when the desired flow or pressure needs to be increased. Booster pump skids are also an ideal solution for flooded-suction applications.

Using the matrix, create a part number for a booster pump skid by specifying number of pumps, flow rate, Total Dynamic Head, voltage, and phase. We will then size the correct pump system based on data provided.

Ordering Guide *(Example: RMS-BP2-150-250-230-3)*

BP2 -	150 -	250 -	230 -	3
NUMBER OF PUMPS	FLOW (GPM)	TDH (Ft)	VOLTAGE	PHASE
1 2	(fill in)	(fill in)	115 208 230 460	1 3

standard filtration packages

After more than 20 years in the Rainwater Harvesting industry, we have identified the key components and the most effective methodology for filtering and disinfecting rainwater for re-use.

BASIS OF DESIGN

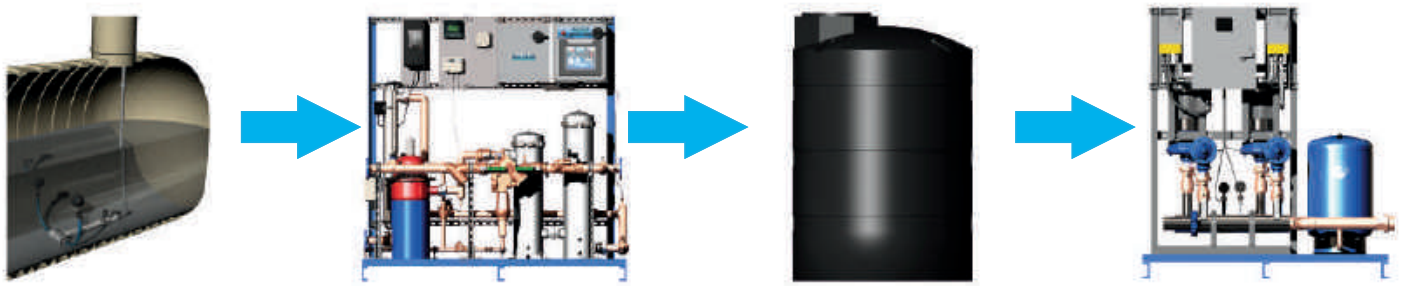
1. Self-cleaning/back-flushing filters are used to remove large sediment particulate, which can carry pathogens and decrease water clarity.
2. Cartridge/Bag Housings are a secondary form of sediment filtration and remove particles large than 5 microns in size.
3. Carbon Filtration reduces discoloration, odor and volatile organic compounds.
4. Ultraviolet Lights are used to sterilize any pathogens and prevent reproduction, making the rainwater safe to use.
5. Domestic back-up lines are integrated into the piping layout to allow for continuous water supply to the end use, should the rainwater supply be depleted.
6. Flowmeters measure flow from both rainwater and domestic sources.
7. ***Pressure differential transmitters*** help determine when sediment and carbon filter elements should be replaced. This increases the accuracy of when to conduct system maintenance.

SYSTEM IMPLEMENTATION

The equipment for the filtration packages has been selected based on flow-rate capacity. As such, each package is named by the maximum flow rate capacity. Standard filtration packages range from 25 gallons per minute to 200 gallons per minute, available in 25 GPM increments. Maximum operating pressure is to be 125 PSI, with minimal operating pressure to be 30 PSI.

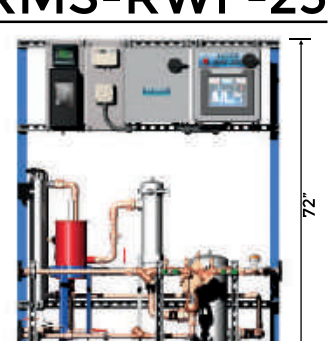
In applications which require higher flow rates and/or higher pressures at the end use, it is recommended to use a “Day Tank” system. A transfer pump will pump water from the primary cistern, through the filtration skid, for storage in a smaller “Day Tank”. A booster pump can then draw water from the Day Tank and send it to the end use at the required flow rate and/or pressure. Filtration skids ***should not*** be placed on the suction side of booster pumps.

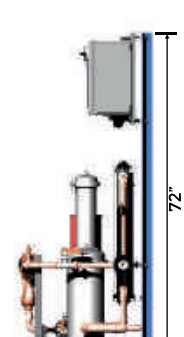
cistern | filtration skid | day tank | pump skid



standard filtration packages

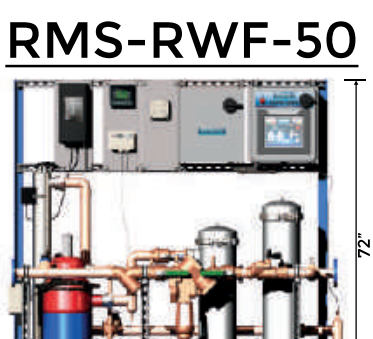
RMS-RWF-25

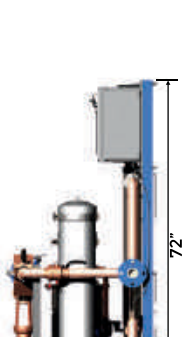




25 GPM PACKAGE DETAILS
RAINWATER INLET: 1" FLANGE
DOMESTIC INLET: 1" FLANGE
SYSTEM OUTLET: 1" FLANGE
DRAIN LINE: 1" FLANGE
BACKWASH FILTER: 50 MICRON
SEDIMENT FILTER: 5 MICRON
UV DOSAGE: 55 mJ/cm²
MAX PRESSURE: 125 PSI

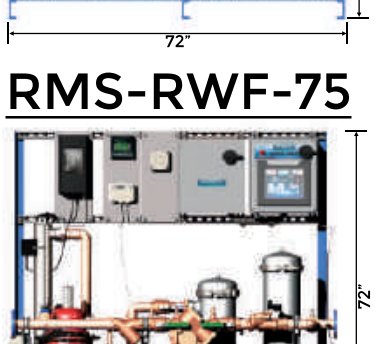
RMS-RWF-50





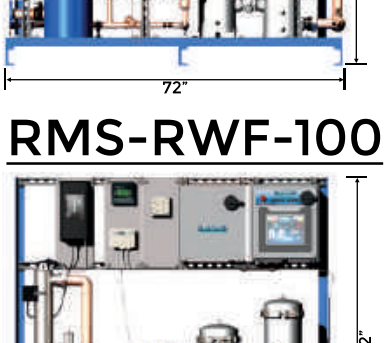
50 GPM PACKAGE DETAILS
RAINWATER INLET: 1-1/2" FLANGE
DOMESTIC INLET: 1-1/2" FLANGE
SYSTEM OUTLET: 1-1/2" FLANGE
DRAIN LINE: 1" FLANGE
BACKWASH FILTER: 50 MICRON
SEDIMENT FILTER: 5 MICRON
UV DOSAGE: 50 mJ/cm²
MAX PRESSURE: 125 PSI

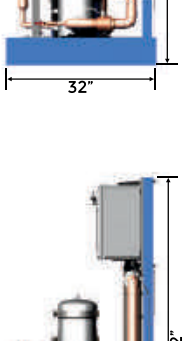
RMS-RWF-75



75 GPM PACKAGE DETAILS
RAINWATER INLET: 2" FLANGE
DOMESTIC INLET: 2" FLANGE
SYSTEM OUTLET: 2" FLANGE
DRAIN LINE: 1" FLANGE
BACKWASH FILTER: 50 MICRON
SEDIMENT FILTER: 5 MICRON
UV DOSAGE: 35 mJ/cm²
MAX PRESSURE: 125 PSI

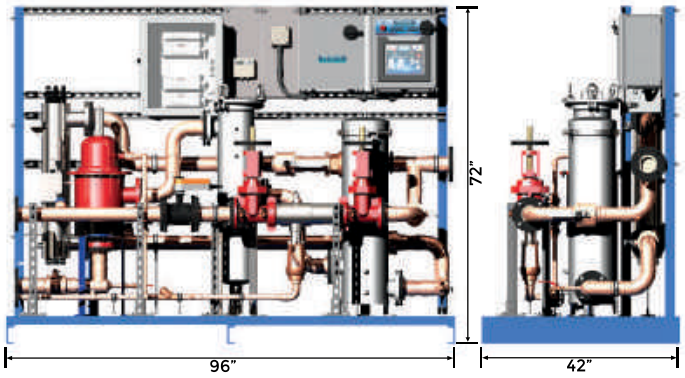
RMS-RWF-100





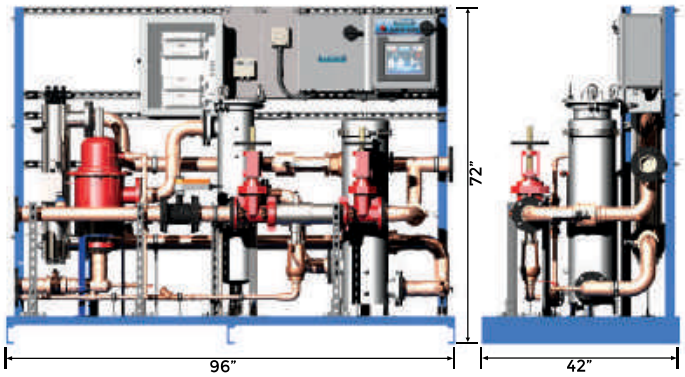
100 GPM PACKAGE DETAILS
RAINWATER INLET: 2" FLANGE
DOMESTIC INLET: 2" FLANGE
SYSTEM OUTLET: 2" FLANGE
DRAIN LINE: 1" FLANGE
BACKWASH FILTER: 50 MICRON
SEDIMENT FILTER: 5 MICRON
UV DOSAGE: 45 mJ/cm²
MAX PRESSURE: 125 PSI

RMS-RWF-125



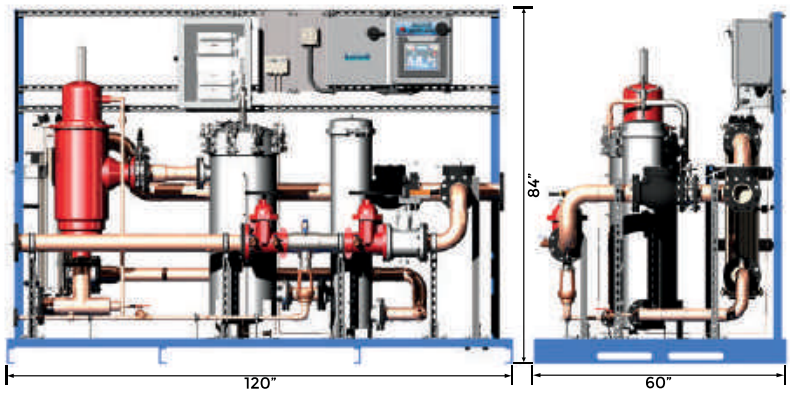
125 GPM PACKAGE DETAILS
RAINWATER INLET: 3" FLANGE
DOMESTIC INLET: 3" FLANGE
SYSTEM OUTLET: 3" FLANGE
DRAIN LINE: 1" FLANGE
BACKWASH FILTER: 50 MICRON
SEDIMENT FILTER: 5 MICRON
UV DOSAGE: 35 mJ/cm²
MAX PRESSURE :125 PSI

RMS-RWF-150



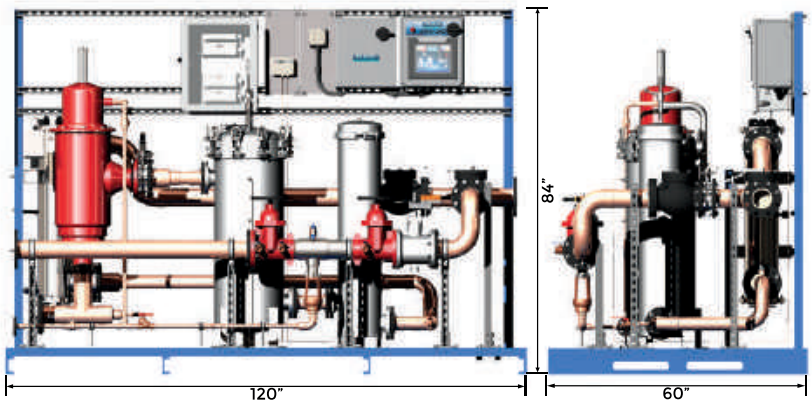
150 GPM PACKAGE DETAILS
RAINWATER INLET: 3" FLANGE
DOMESTIC INLET: 3" FLANGE
SYSTEM OUTLET: 3" FLANGE
DRAIN LINE: 1" FLANGE
BACKWASH FILTER: 50 MICRON
SEDIMENT FILTER: 5 MICRON
UV DOSAGE: 37 mJ/cm²
MAX PRESSURE: 125 PSI

RMS-RWF-175



175 GPM PACKAGE DETAILS
RAINWATER INLET: 3" FLANGE
DOMESTIC INLET: 3" FLANGE
SYSTEM OUTLET: 3" FLANGE
DRAIN LINE: 1" FLANGE
BACKWASH FILTER: 50 MICRON
SEDIMENT FILTER: 5 MICRON
UV DOSAGE: 33 mJ/cm²
MAX PRESSURE: 125 PSI

RMS-RWF-200



200 GPM PACKAGE DETAILS
RAINWATER INLET: 4" FLANGE
DOMESTIC INLET: 4" FLANGE
SYSTEM OUTLET: 4" FLANGE
DRAIN LINE: 1" FLANGE
BACKWASH FILTER: 50 MICRON
SEDIMENT FILTER: 5 MICRON
UV DOSAGE: 43 mJ/cm²
MAX PRESSURE: 125 PSI

add-on skids

We have developed several “add-on” skids to accompany the standard filtration packages. These skids include components that are often associated with rainwater harvesting systems and we have chosen the more common sizes. Skids are designed to be joined with existing filtration skids. RMS can also offer custom solutions should the skids below not meet system design requirements.

injection systems

Injection tank systems can be used to inject chlorine or dye into systems as needed. Injection point must be at a higher piping elevation than the injection pump. System flow rates and pressure must be known when specifying an injection system. System includes tank & pump. Chlorine & dye supplies not provided by RMS.

	RMS-IT-15	RMS-IT-35	RMS-IT-55
CAPACITY	15 Gallons	35 Gallons	55 Gallons
LENGTH	24”	24”	24”
DEPTH	32”	32”	32”
HEIGHT	36”	44”	44”
POWER REQ.	115-Volt	115-Volt	115-Volt

pressure tanks

Pressure tanks to be skid-mounted and include appropriately sized tank tee. Maximum pressure to be 125 psig. Tanks with higher pressure ratings are available upon request.

	RMS-PT-14	RMS-PT-32	RMS-PT-62	RMS-PT-85	RMS-PT-119
CAPACITY	14 Gallons	32 Gallons	62 Gallons	85 Gallons	119 Gallons
LENGTH	24”	24”	24”	32”	32”
DEPTH	32”	32”	32”	32”	32”
HEIGHT	28”	34”	54”	51”	66”
PIPE SIZE	1”	1-1/4”	1-1/4”	1-1/4”	1-1/4”

day tanks

Day tanks to be skid-mounted and include eyebolts for tie-downs. Tie-downs by others.

	RMS-DT-500	RMS-DT-1000	RMS-DT-1550
CAPACITY	500 Gallons	1000 Gallons	1550 Gallons
LENGTH	56”	72”	95”
DEPTH	56”	72”	95”
HEIGHT	79”	86”	93”

(for booster pump add-on skids, see page 7)

sample specification

RMS has fully-written specifications for our standard filtration packages and can also assist in writing specifications for rainwater harvesting and stormwater management systems. Below is a sample of the specification of a filtration package provided by RMS.

1.1 General Information

A. Specifications for the rainwater harvesting system are based on Rainwater Management Solution's integrated system with an intended scope to provide sole source accountability. This section describes the technical specifications and general instructions for furnishing, factory testing, handling, delivery and installation of water transfer, storage distribution, treatment equipment and components related to a rainwater harvesting system.

Full system specifications are available via www.rainwatermanagement.com/requestspec/

design-a-skid

If your system requires a different design than any of the standard filtration packages, call us today to find the custom solution or use the product matrix below to build your own. Flowrate and at least one form of filtration are required. We build and plumb custom skids in our manufacturing facility. Our skids are plumbed in either Copper Press (standard), Stainless-Steel Press, or Sch. 80 PVC.

Ordering Guide *(Example:RMS-75G-25SC-5S-1S-C-UV3-CL-BU)*

75G	-	25SC	-	5S	-	1S	-	C	-	UV3	-	CL	-	BU

FLOW RATE	SELF-CLEANING*	SEDIMENT FILTER	SEDIMENT FILTER*	CARBON FILTER	UV LIGHT*	PIPE PLUMBING	BACK-UP
(GPM) 15 25 35 50 75 100 125 150 175 200	(MICRON RATING) BLANK=NO FILTER 25 50 80 100 *SELF-CLEANING FILTER OPTIONAL—REDUCES MANUAL MAINTENANCE	(MICRON RATING) BLANK=NO FILTER 1 5 10 25 50 70	(MICRON RATING) BLANK=NO FILTER 1 5 10 25 50 70 *SECOND SEDIMENT FILTER OPTIONAL	(IMPLEMENTATION) BLANK=NO FILTER C=CARBON FILTER	(UV DOSAGE) UV1= US PUBLIC HEALTH (16 mJ/cm²) UV2= 30 mJ/cm² UV3=NSF/EPA (40 mJ/cm²) *HIGHER DOSAGES AVAILABLE AS NEEDED	(MATERIAL) CL=COPPER TYPE L CK=COPPER TYPE K SS=STAINLESS STEEL P80=PVC SCH. 80	(DOMESTIC) BLANK=NO BACK-UP BU=BACK-UP ON SKID

NOTE: Most systems involving a UV light require water to be filtered to a minimum level of 5 microns prior to the UV light in order to be effective in sterilizing the pathogens in the water. RMS recommends carbon filtration in addition to sediment filtration to ensure the best water quality for your end use.

filtration options

In addition to pre-plumbed filtration skids, we can offer filtration and disinfection components separately. Sediment filtration, carbon filtration, and ultraviolet light are our most common methods of filtration and disinfection. Find out how we can provide a solution to your water filtration needs!

sediment filtration

Sediment filtration is used to remove particulate from the rainwater line that may carry pathogens and decrease water clarity. Sediment filtration is usually the first step to post-tank treatment of water. Use the matrix below to select a sediment filter housing.

Ordering Guide *(Example: RMS-BF-50-25-1.5-FP)*

BF	-	50	-	25	-	2	-	3
TYPE OF FILTER		FLOW (GPM)		MICRON RATING		CONNECTION SIZE		CONNECTION TYPE
SC=SELF-CLEANING BF=BAG FILTER CTF=CARTRDIGE FILTER		(fill in)		1 5 10 25 50 75 100		1” 1-1/2” 2” 3” 4”		MP=MNPT FP=FNPT F=FLANGED

carbon filtration

Carbon filtration reduces discoloration, odor and volatile organic compounds. Carbon filters are especially helpful in greenroof applications. Use the matrix below to select a carbon filter housing.

Ordering Guide *(Example: RMS-C-50-2-MNPT-T)*

50	-	2	-	MNPT	-	T
FLOW (GPM)		CONNECTION SIZE (in.)		CONNECTION TYPE		MOUNTING
(fill in)		1.5 2 (standard)		MNPT=MALE PIPE (STANDARD) FNPT= FEMALE PIPE F=FLANGE		L=LEGS T=TABS

ultraviolet lights

Ultraviolet lights are used to sterilize any pathogens and prevent reproduction, making rainwater safe for re-use. Use the matrix below to select an ultraviolet light.

Ordering Guide *(Example: RMS-UV-50-16)*

50	-	16
FLOW (GPM)		UV DOSAGE (mJ/cm^2)
(fill in)		16=US Public Health 30 40=NSF/EPA

controls

RMS offers custom rainwater harvesting controllers that are built, programmed, and tested in our UL 508A Panel Shop.

RMS has developed two touch-screen Programmable Logic Controllers for the rainwater harvesting industry:

- RMS Series 200 Controller: 10.4” screen
- RMS Series 200 Mini Controller: 5.7” screen

These PLCs are the “brains” behind our more advanced rainwater harvesting systems, monitoring digital and analog inputs to control outputs or display information pertaining to the system. Controllers can integrate with building automation systems, allowing for remote monitoring of the rainwater system. In addition, we have developed several basic controllers to operate and monitor systems.

RMS SERIES 200 CONTROLLER

RMS can also provide single-point connection power distribution panels to minimalize the amount of on-site high-voltage wiring that must be done for a project.

Our controls engineering and design team will work with you to provide the custom solution that you need for your rainwater harvesting system.

sensors & valves

RMS has established relationships with leading manufacturers to ensure complete yet flexible product integration in our rainwater harvesting systems. We can offer full-system integration due to our in-house design and manufacturing capabilities.

Components offered include (but are not limited to):

- flowmeters: ultrasonic and paddlewheel
- level sensors: ultrasonic and pneumatic
- motorized valves: ball, butterfly, modulating, 3-way
- pressure differential transmitters
- pH sensors
- oxygen sensors




We can integrate these components for control and monitoring through our RMS Series 200, RMS Series 200 Mini Controllers, and other controls platforms.

RMS
RAINWATER MANAGEMENT SOLUTIONS™

V1.0 01-19

www.rainwatermanagement.com
phone: 1-866-653-8337 or 540-375-6750

ARCSA
American Rainwater Catchment Systems Association

Front Cover Image of Royal® Reclaimed Water Flushometer courtesy of Sloan Valve Company and is used with permission.